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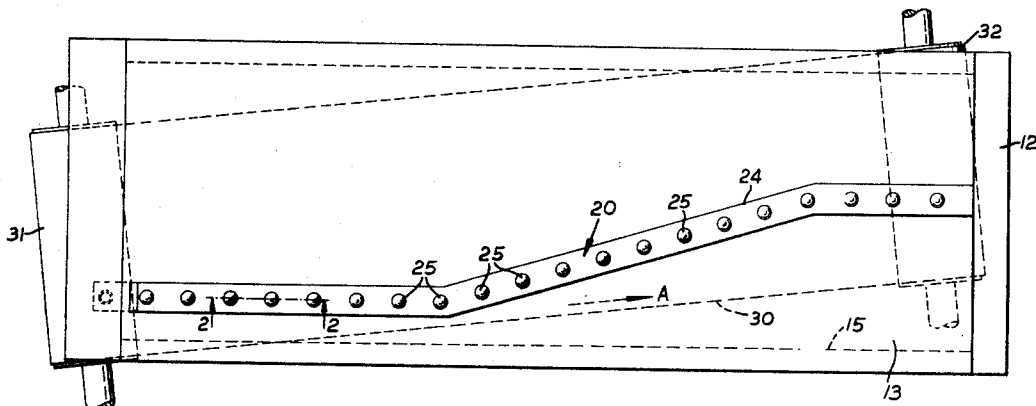
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[54] **SHEET-FEEDING DEVICES**
14 Claims, 3 Drawing Figs.

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 271/52
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 [50] Field of Search..... 271/48, 49,
 52, 58, 59

ABSTRACT: A sheet-feeding device comprising a feed path between a pair of superimposed plates and an intervening aligned surface wherein the sheets are transported along the feed path and towards aligning surface by at least one row of balls wherein the latter are rotated by a common driving belt, the axis of movement of the latter being preferably angularly adjustable relevant to the aligning surface.



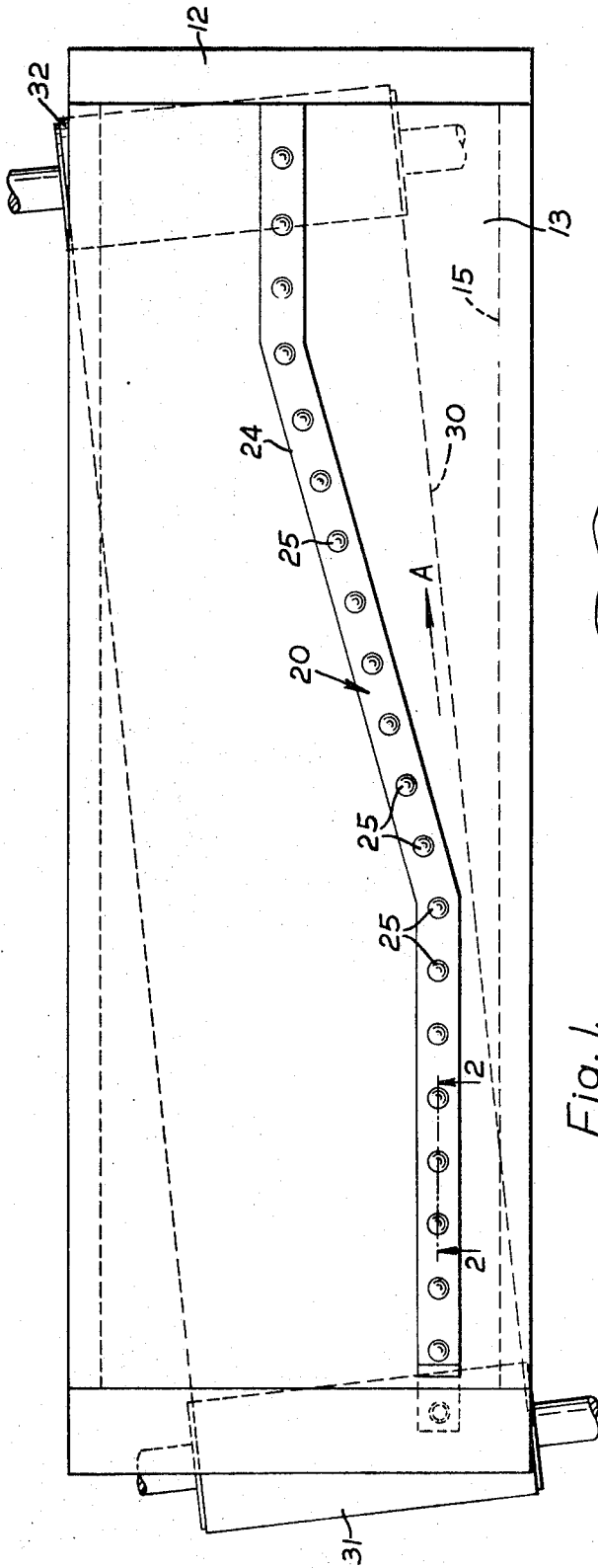


Fig. 1.

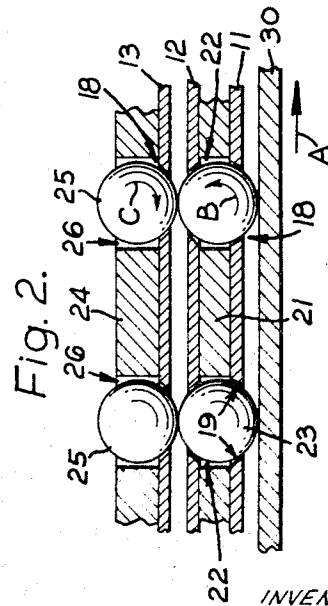


Fig. 2.

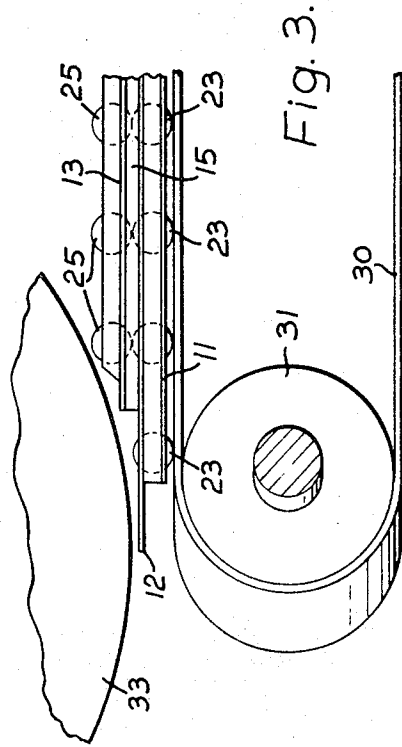


Fig. 3.

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SHEET-FEEDING DEVICES

This invention relates to sheet-feeding devices and has for its object to provide improved means for aligning an edge of each of a sequence of sheets in transit.

In accordance with this invention a sheet feeding device comprises a feed path having an aligning surface defining one edge of the feed path, feeding means comprising at least one row of at least part-spherical sheet driving members mounted for rotation and serving to move sheets along the feed path and towards the aligning surface, and means for driving the members.

A preferred embodiment of the invention is more particularly described with reference to the accompanying drawings, wherein:

FIG. 1 is a plan view of a sheet-feeding device according to the invention;

FIG. 2 is an enlarged sectional side elevation on line 2—2 of FIG. 1; and

FIG. 3 is an enlarged side elevation of an output end of the device.

Referring to the drawings (FIGS. 2 and 3) the sheet-feeding device comprises three vertically spaced, horizontally disposed plates 11, 12, 13, wherein the two upper plates 12 and 13 define upper and lower sides of a feed path, and wherein the two uppermost plates 12, 13 are interconnected by a relatively longitudinally extending perpendicular wall which defines an aligning surface 15 (indicated by a dotted line in FIG. 1) constituting an edge of the feed path.

Each plate has a plurality of frustoconical apertures 18 defined by a bevel wall 19. In the uppermost and lowermost plates 13 and 11, each aperture 18 has its smaller diameter uppermost.

A block of material 21 is positioned between and in contact with the two lowermost plates 11, 12 and has a series of vertically cylindrical circular apertures 22 each registering with respective apertures 18 in the adjacent plates.

In each block aperture 22, there is loosely contained a driving ball 23 which projects through its respective upper and lower plate apertures 18 wherein the bevel walls 19 of the latter serve as mounting sockets to retain the driving ball in position so that the ball is rotatable in all directions.

The driving balls 23 are arranged in a single width row in an elongated Z configuration, extending from the input end to the output end of the feed path. At each end of the feed path the balls lie parallel to the aligning surface 15 and the intermediate part 20 of the configuration converges towards the aligning surface in the direction of transit of sheets fed in sequence along the feed path (i.e., from right to left in the drawings).

The uppermost plate 13 has its apertures 18 registering with respective apertures in the other plates and carries a block 24, similar to block 21 described above, the block 24 having a plurality of cylindrical apertures 26 containing respective idler balls 25. The idler balls 25 are rotatably retained in position by the bevel walls 19 of the upper plate 13 and are positioned directly above respective driving balls 23 in register therewith.

The two lowermost plates 11, 12 project beyond the uppermost plate 13 at the output end of the device, the two lowermost plates mounting in the projecting portions one driving ball extra to the number of idler balls carried by the uppermost plate 13.

The idler balls 25 are urged downwardly by gravity and the driving balls 23 are urged upwardly in operation of the device, by contact of their lower surfaces with an endless driving belt 30 having its upper run extending immediately below the lowermost plate 11.

The belt 30 extends over a pair of pulleys 31, 32 at respective ends of the device, and one pulley is driven to transport the belt. The pulleys are angularly adjustable whereby the angle between the axis of movement of the belt and the aligning surface, is variable.

When the driving belt is driven (direction A in FIGS. 1 and 2), the driving balls 23 in contact therewith are rotated

(direction B in FIG. 2), and serve to transport sheets along the feed path. To apply a transverse component of movement to the sheets, the driving belt is set to operate at an acute angle α with respect to the aligning surface 15 whereby the driving balls 23 serve to move the sheets continuously along the feed path and simultaneously towards the aligning surface. The peripheral plane of rotation of each ball and the peripheral part of the surface of the ball serving to drive the sheets along the feed path change according to the angle at which the belt is set.

After a sheet has been brought into edge-to-edge contact with the aligning surface, the sheet continues to move through the device whilst abutting the aligning surface, so that a sequence of sheets are accurately aligned when leaving the device. The sheets are removed from the device at the output end by a vacuum drum 33.

The variable adjustment of the belt angle permits variation of the transverse speed component given to the sheets being conveyed along the feed path, i.e., the speed component perpendicular to the aligning surface, and enables different sizes and weights of sheets to be handled by the device.

The idler balls 25 in the upper block 26 serve merely to apply a pressure to the sheets to maintain driving contact between the sheets and the driving balls 23 and will be driven in the opposite rotational direction to the driving balls 23 (direction C in FIG. 2).

To reduce frictional resistance to rotation of the balls, the bevel walls 19 may be composed of or coated with a low friction material such as nylon or polytetrafluorethylene. The balls may be made of any suitable material such as for example nylon or steel. Further rows of balls may be provided if desired.

In alternative embodiments, the apertures in the blocks may be part-spherically shaped to retain the balls and the arrangement of balls may be a straight line configuration instead of an elongate Z configuration, the straight line converging towards the aligning surface.

The feeding means described above has substantial advantages over conventional sheet feed arrangements which employ inclined rollers, as for example disclosed in U.S. Pat. specification Ser. No. 896,631. In particular, the use of a driven ball feed in conjunction with a substantially wholly enclosed (except at its ends) feed path defined between the plates 12, 13 and the aligning surface 15 avoids the presence of gaps of a type which would otherwise create significant danger of trapping the sheets.

I claim:

1. A sheet-feeding device comprising upper and lower vertically spaced substantially parallel plates defining a longitudinal sheet feed path between them, means defining a sheet aligning surface extending between said plates and along one edge of said path, feeding means serving to transport the sheets along the feed path while urging them toward sliding engagement with said sheet alignment surface comprising at least one row of spherical universally rotatably mounted sheet driving members disposed along said path, one of said plates being formed with a plurality of substantially circular apertures and said sheet driving members projecting through said apertures into the feed path where they are in driving contact with the sheets being transported along said path, and means for driving all of said members.

2. A device according to claim 1, wherein the means for driving the driving members comprises a driven belt directly engageable with and common to all of the driving members.

3. A device according to claim 2, wherein the belt is endless.

4. A device according to claim 2, wherein the longitudinal axis of movement of the belt is angularly adjustable relative to the aligning surface.

5. A device according to claim 2, wherein the belt is carried by pulleys whose axes of rotation are angularly adjustable relative to the aligning surface to provide the belt axis adjustment.

6. A device according to claim 2, wherein each driving member is mounted for rotation in different directions so that

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the peripheral part of the member surface serving drivably to engage the sheets is variable with variation of the angle of the belt axis.

7. A device according to claim 2, wherein the driving members project upwardly into the feed path through apertures in the lower plate, and are rotatably driven by the belt which is disposed beneath the members.

8. A device according to claim 1, wherein at least a part of the row of driving members converges towards the aligning surface in the direction of transit of sheets through the device.

9. A device according to claim 8, wherein the row of driving members has two mutually parallel limbs at opposite ends of the feed path, said limbs being substantially parallel to the feed path and to said sheet aligning surface, and said converging part is a connecting limb disposed between said parallel limbs, said connecting limb extending at an angle to said sheet aligning surface.

10. A sheet-feeding device as defined in claim 9, wherein the upper plate is formed with apertures registered with the lower plate apertures, and rotatable idler balls are mounted on

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said upper plate to project through the apertures thereof into the feed path, so that said sheets are transported between registered drive and idler balls along said path.

11. A device according to claim 1, including spherical idler members rotatably mounted to urge sheets in transit into engagement with the driving members.

12. A device according to claim 11, wherein the idler members are mounted directly above respective driving members in register therewith.

13. A device according to claim 11, wherein the idler members project through apertures in an upper plate defining an upper side of the feed path.

14. A sheet feeding device as defined in claim 1, wherein apertures are formed in the lower plate and said spherical members are balls each rotatably mounted in sockets below said path so as to be rotatable in all directions in said sockets, and said balls extend with minimum clearance through said lower plate apertures and said driving means is a belt contacting all of the balls below said lower plate.

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